

Impact of the Assimilation of AIRS Soundings and AMSR-E Rainfall on Short Term Forecasts of Mesoscale Weather

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Joint AMSR Science Team Meeting 4 Aug 2004



Investigators

- CAPS/Univ of Oklahoma
 - Keith Brewster
 - Fred Carr
 - Jidong Gao
 - Shanna Sampson
- NASA Short-term Prediction Research and Transition Center (SPoRT) NSSTC, Huntsville
 - Bill Lapenta
 - Gary Jedlovec



CAPS Tools

- ARPS: Advanced Regional Prediction System
- ADAS: ARPS-Data Analysis System
- ARPS-3DVAR
- ARPS Incremental Analysis Updating (IAU)
- ARPS-to-WRF Translator
- WRF Development Collaborators



NASA SPoRT

- Transition to Operations:
Collaboration with NWS-Huntsville and other
Weather Service Forecast Offices
 - MODIS
 - GOES Sounder data
 - Lightning network data
- Experience with using satellite data in modeling & assimilation research (MM5 and WRF)
- AIRS Validation



ADAS as Used by AMU at Kennedy Space Center

Others:

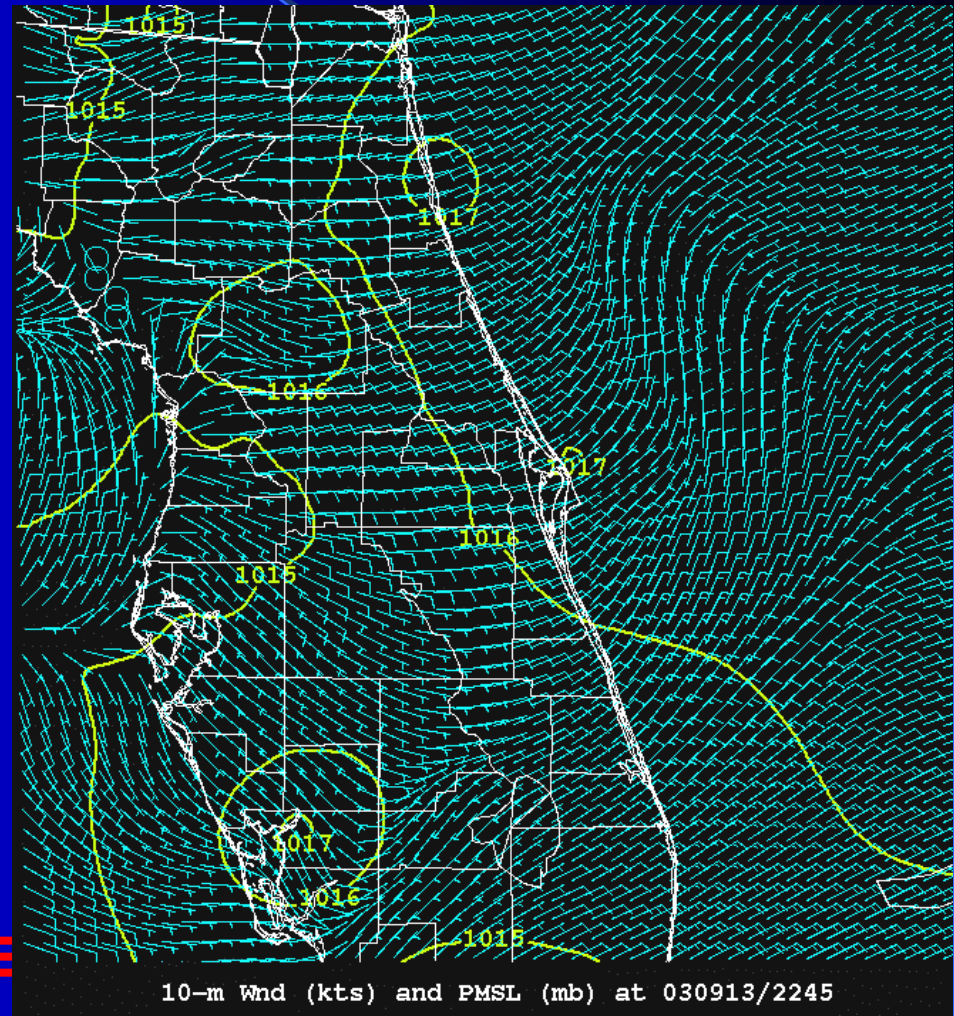
NASA SMG Houston

Univ of Utah & Western

Region NWS Offices

Galicia Spain

Korean Meteor. Agency



ADAS

- Bratseth Successive Corrections
Approximates Optimal Interpolation
- Calculated directly on model grid
- Analyze u, v, p, θ, q_v
- Deduce cloud and rainwater
 q_c, q_r, q_i, q_s, q_h
- Diagnose w
- Adaptable, easy to implement



ADAS Cloud

- GOES Satellite Data
 - Vis: Cloud fraction
 - IR: Cloud top temperature
 - In the works: Cloud Top Pressure
- Radar Data
 - Reflectivity to hydrometeors
- Surface Observations
 - Cloudbase height
- Initially based on FSL/LAPS Cloud Adaptation and many updates by CAPS
 - Zhang et al.1999 & Brewster, 2002

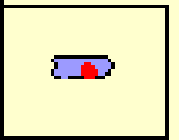
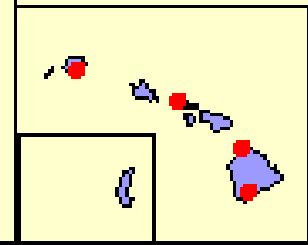
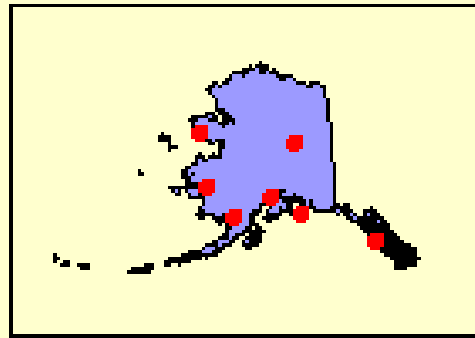
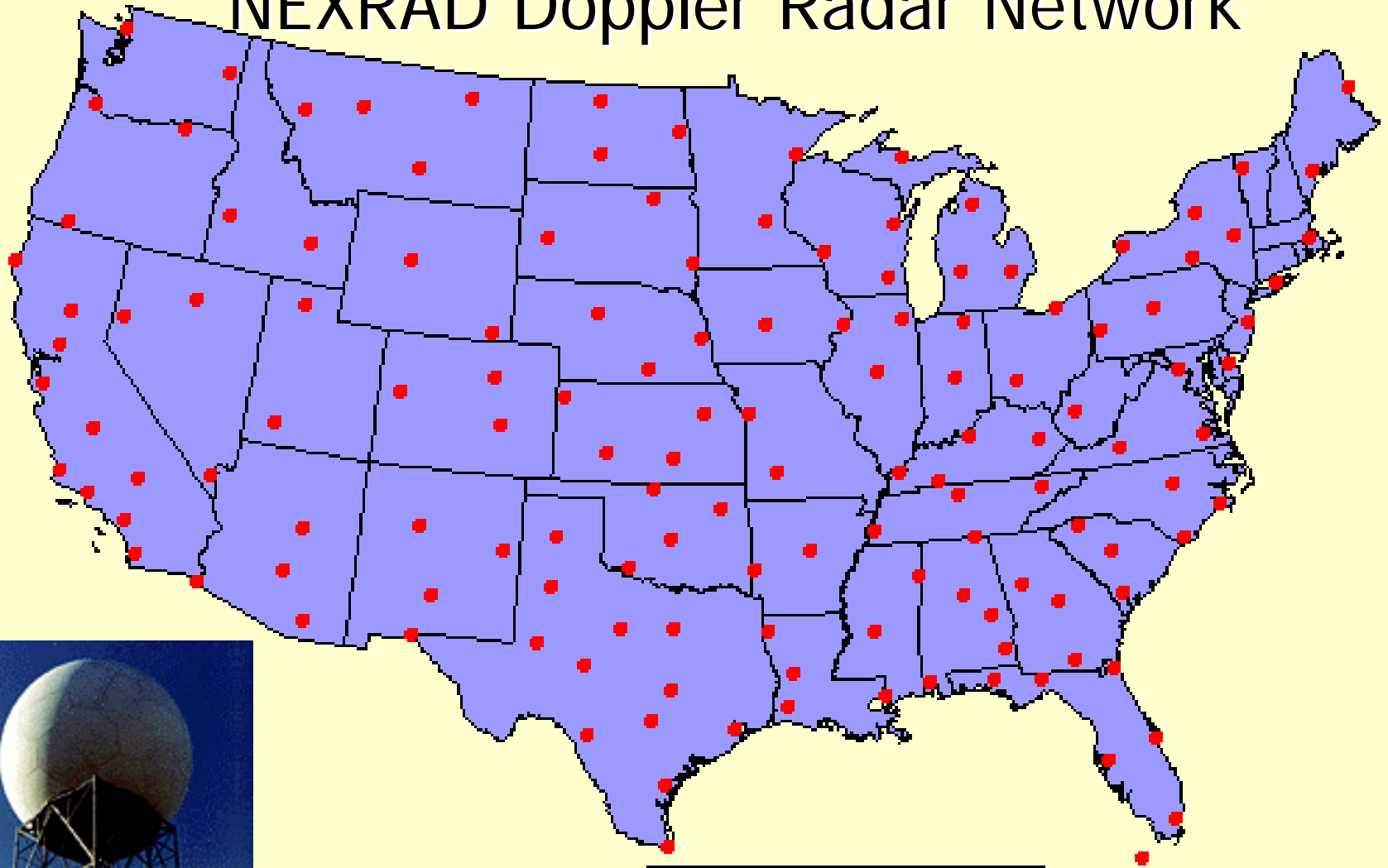


Finding the Cloud Water

- Use parcel theory to find saturation dq_v/dz
use to increment cloud water
- Water is carried with parcel - less a mixing/dilution factor (Warner curve)
- Ice created when colder than -10 C
- Latent heat release is added to θ



NEXRAD Doppler Radar Network



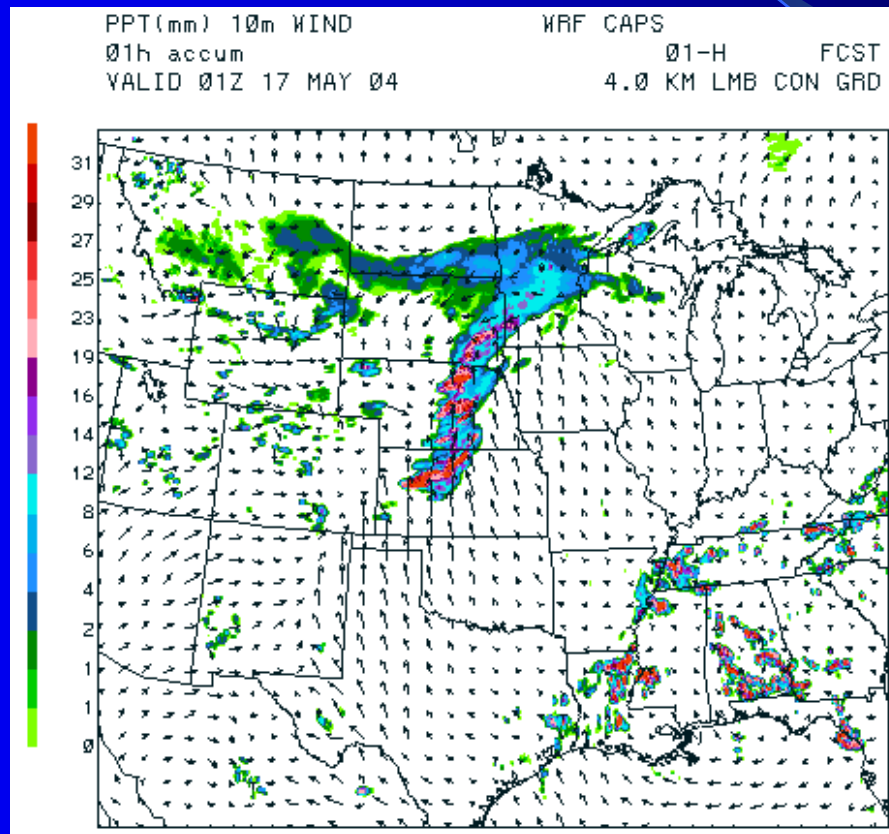
2004 SPC/NSSL Spring Prediction Experiment

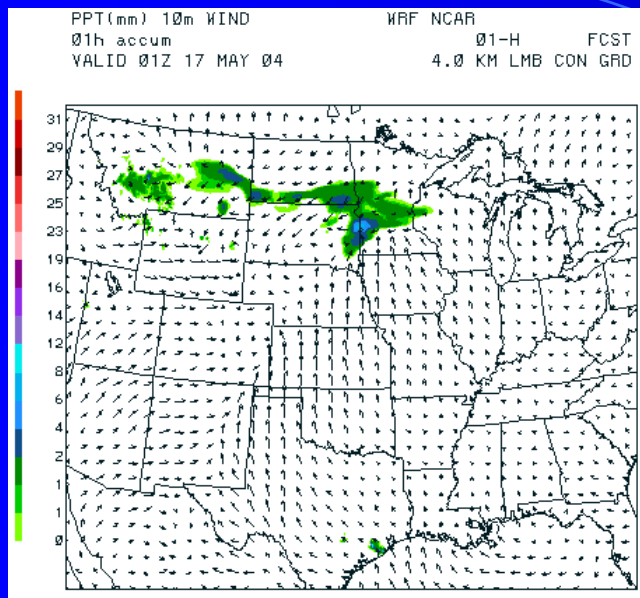
- CAPS ran the ARPS and WRF at 4 km resolution
- Initialized with NEXRAD radar, GOES and surface data
- 00Z 30hr and 12Z 18 hour forecasts
- Experiments conducted from 12 April – 4 June 2004
- <http://www.caps.ou.edu/wx/spc>



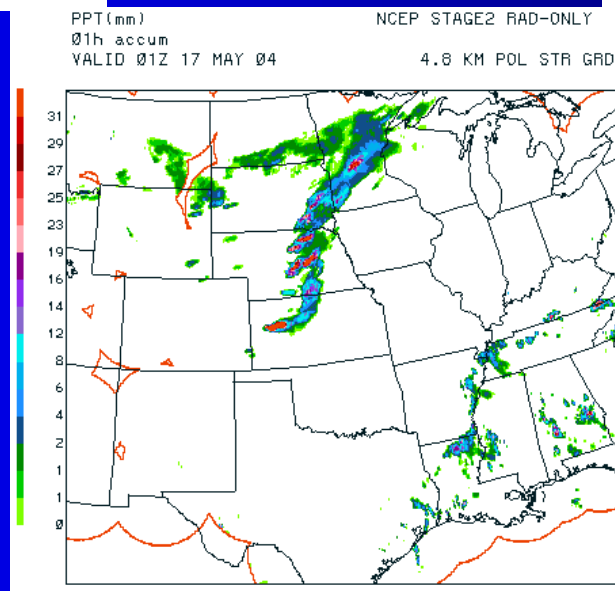
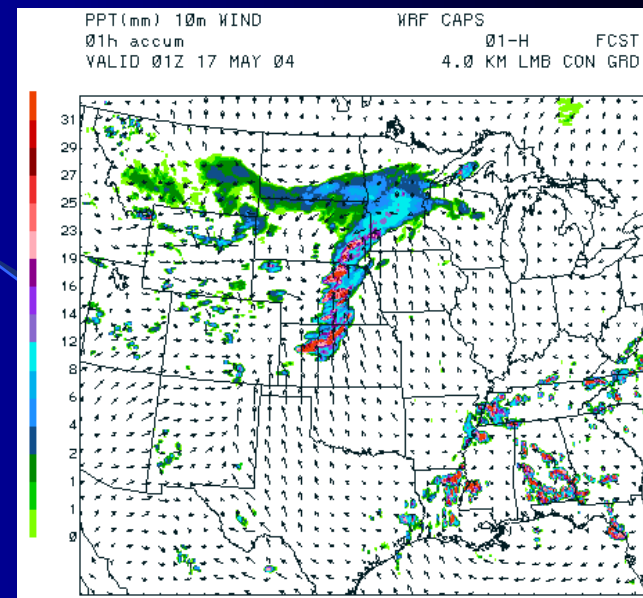
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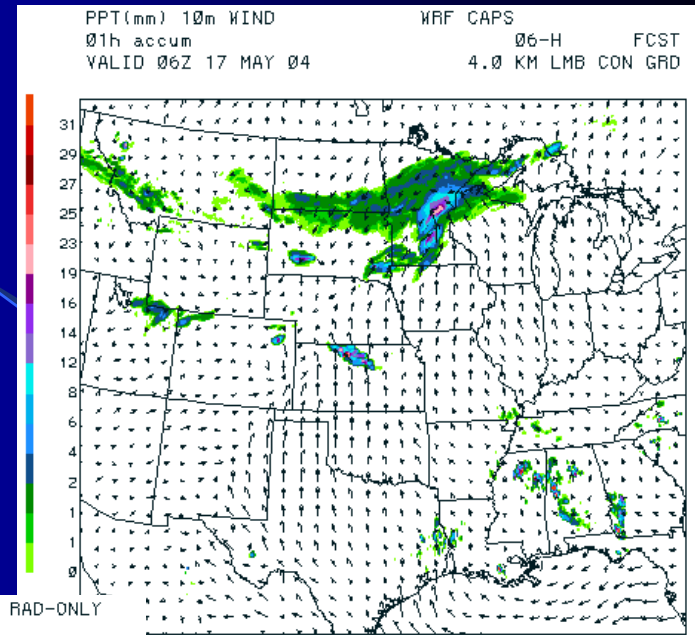
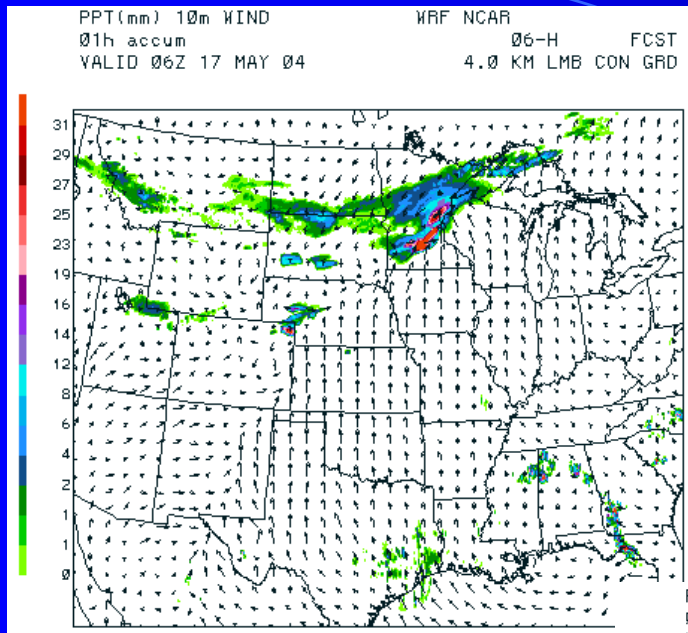
Preliminary results: May 17th 00Z run, compare CAPS and NCAR WRF's



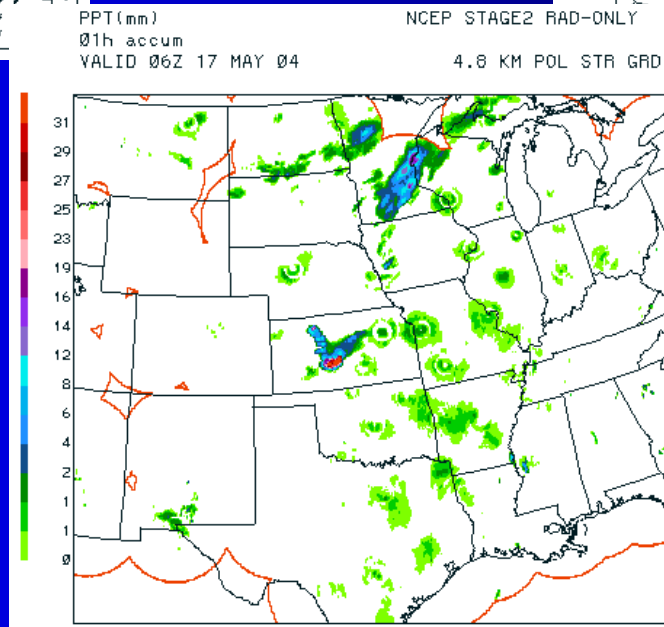


Radar



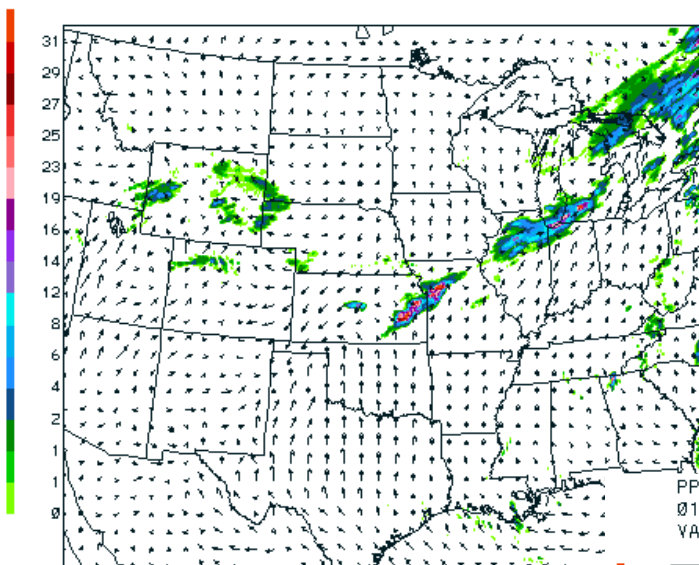


Radar



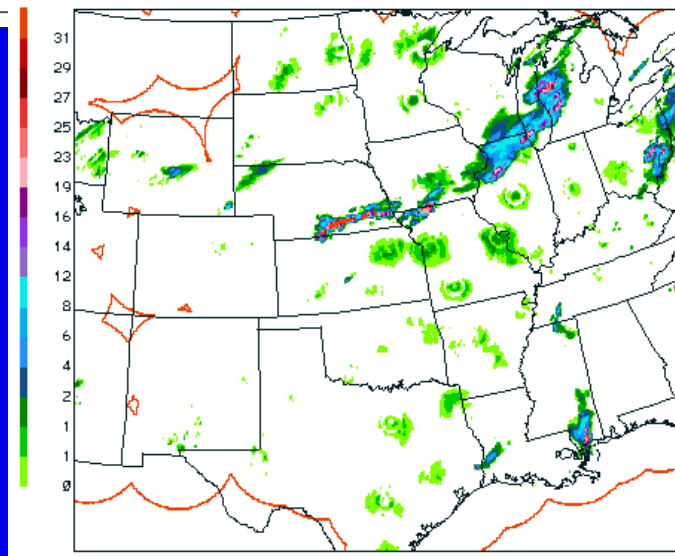
NCAR WRF 30-hour forecast (1-hr Acc Precip) CAPS WRF

PPT(mm) 10m WIND
01h accum
VALID 06Z 18 MAY 04
WRF NCAR
30-H FCST
4.0 KM LMB CON GRD

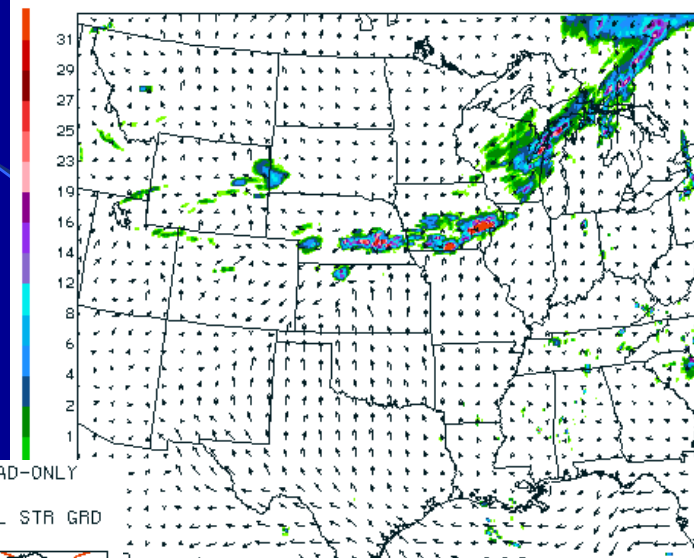


Radar

PPT(mm)
01h accum
VALID 06Z 18 MAY 04
NCEP STAGE2 RAD-ONLY
4.8 KM POL STR GRD



PPT(mm) 10m WIND
01h accum
VALID 06Z 18 MAY 04
WRF CAPS
30-H FCST
4.0 KM LMB CON GRD



Recent Research Results

- Able to initialize and maintain individual storm cells in storm-resolving models
- Able to use radar reflectivity and winds at high resolution
- Positive impact lasting several hours

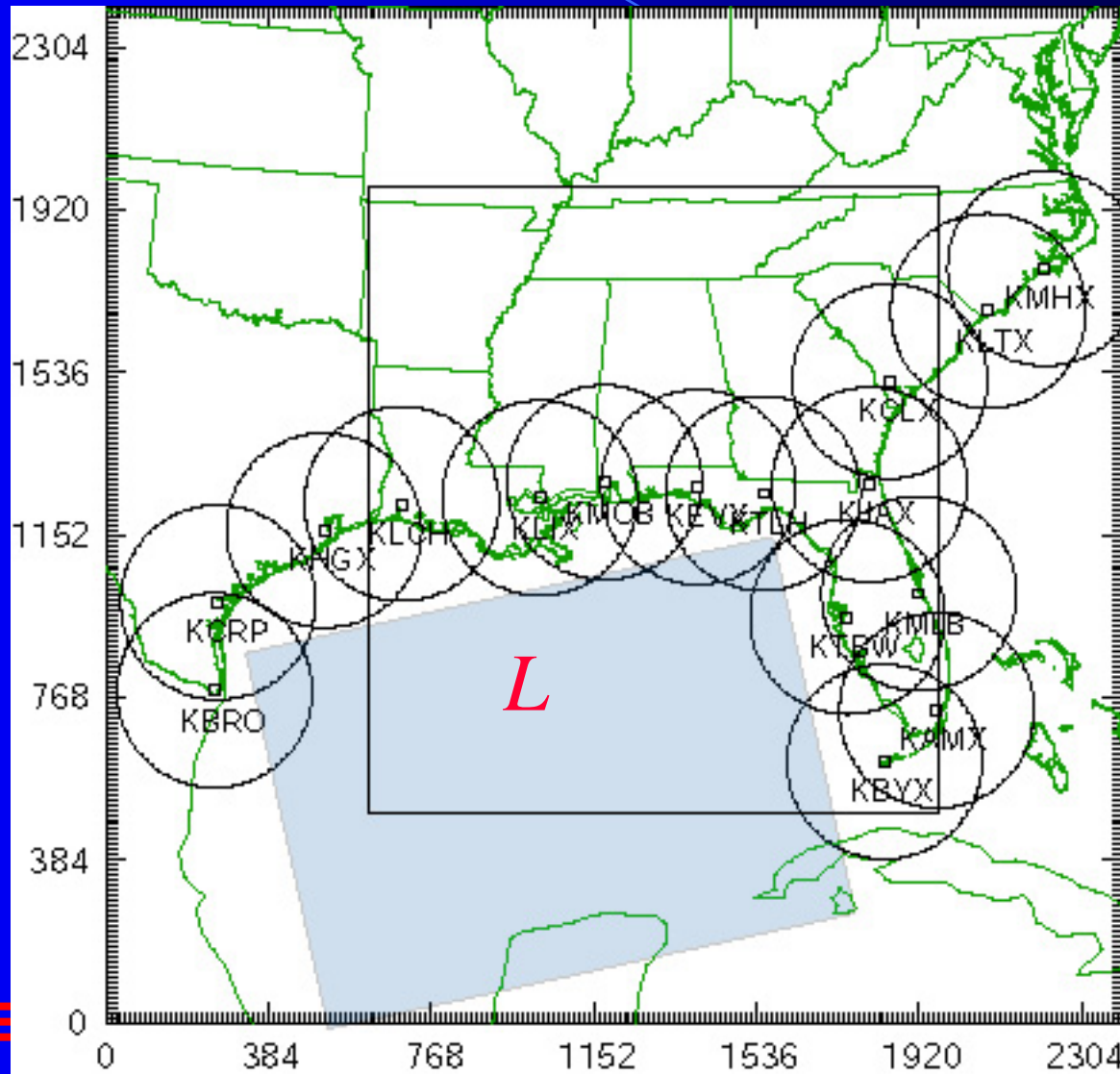


Attraction of AMSR-E Data

- All-weather
- High resolution
- Mid-day overpass updates 12 UTC information
- Complements Radar Coverage



Coastal NEXRAD Coverage and AMSR-E Precipitation



Proposed Use of AMSR-E Precipitation

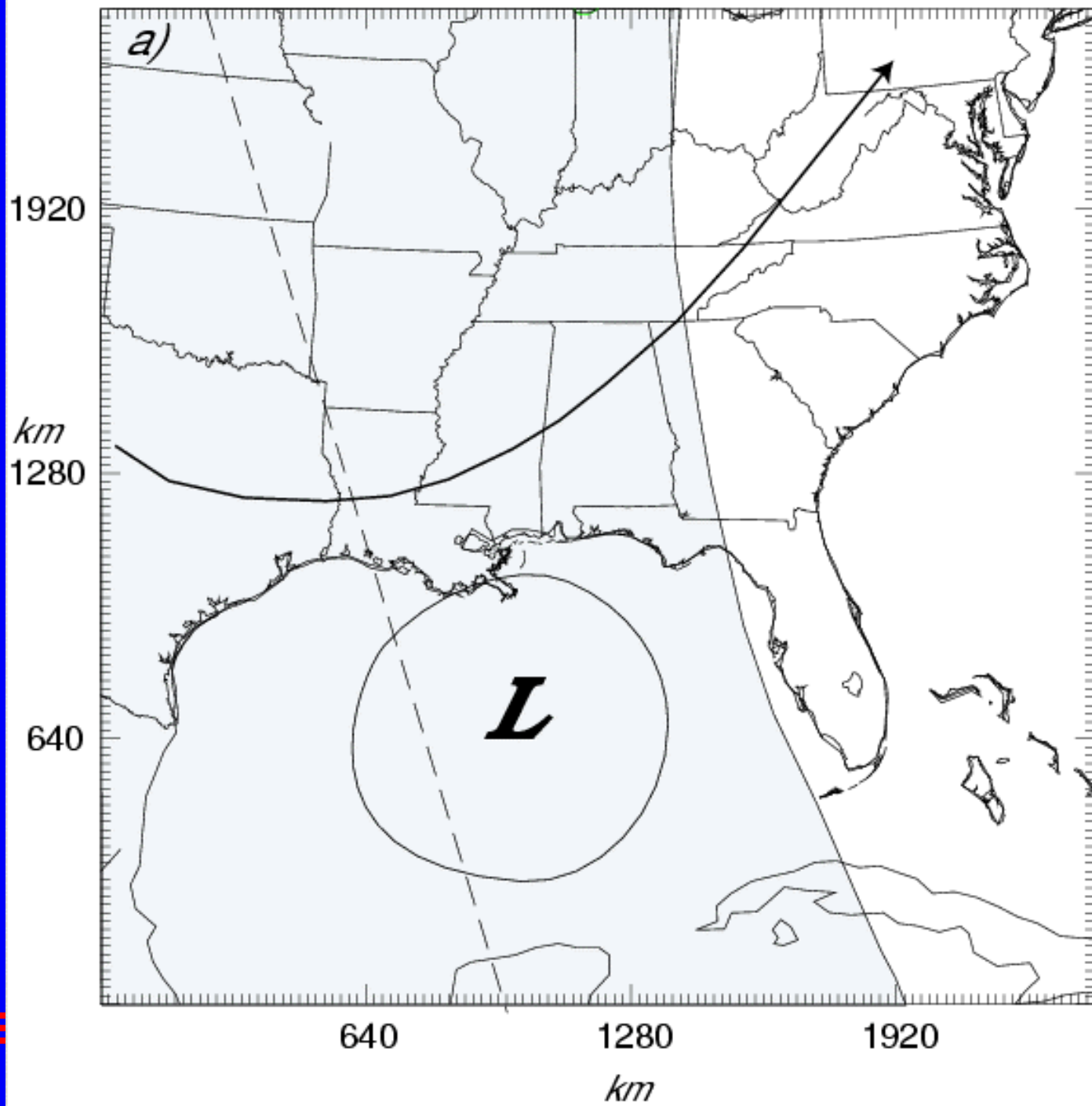
- Merge with NEXRAD data to map precipitation/cloud fields
- For $dx=10-20$ km update latent heating based on convective parameterization
 - Betts-Miller-Janjic
 - Kain-Fritsch
- For $dx < 10$ km Update cloud fields and latent heating via cloud analysis program

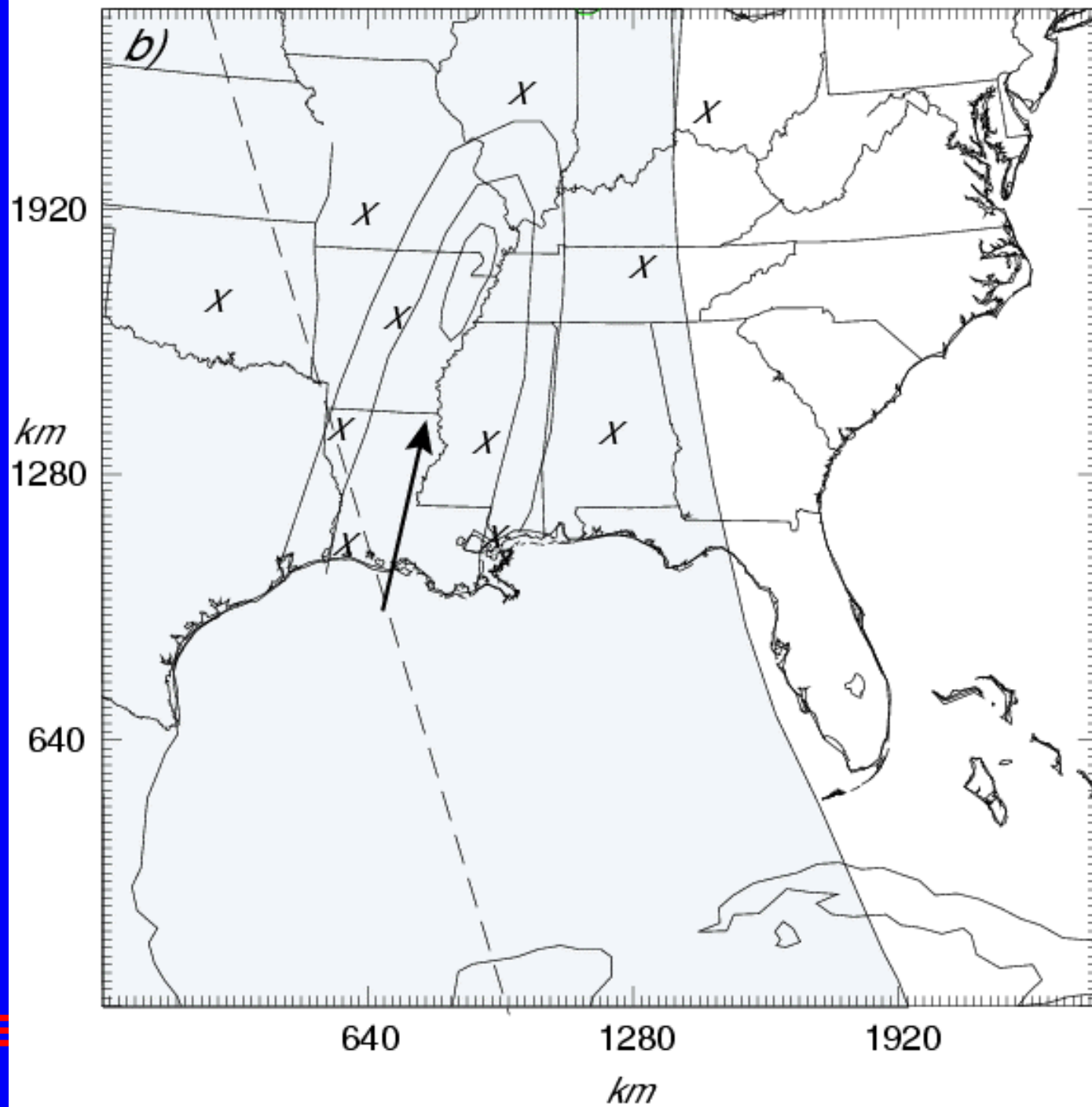


Possible Use of Other Data

- Update Sea-Surface Temperature
- Use integrated cloud water as a constraint in cloud analysis







Initial Work Timeline

- Summer-Fall 2004
 - Extended visit to SPoRT for Student and PI
 - Learn about data quality & validation efforts
 - Learn access procedures
 - Obtain I/O software and modify for our use
 - Obtain SARTA for AIRS forward model work
 - Develop code to ingest AIRS soundings in ADAS
- Winter 2004-05
 - Identify one or two cases for study and obtain initial AIRS and AMSR-E data
 - Determine appropriate modifications to KF and/or BMJ to implement precipitation adjustment

